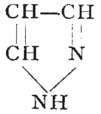
IN the new number of the *Internationales Archiv für Ethnographie*, Hermann Strebel continues his paper on a peculiar kind of stone object, found in Mexico and Central America, which is generally supposed to have been used in connection with the sacrifice of human victims. It is fashioned in the shape of a yoke or bow, and enriched with sculpture. Herr Strebel shows that it was worn as a mark of honour by persons of high rank. The sculpture was, he believes, of a symbolical character. Dr. L. Lewin, of Berlin, contributes an interesting paper on betel-chewing, adding fresh information to that which he brought together in a previous article. M. de Clercq gives some notes (in Dutch) relating to New Guinea, and Herr H. Vos deals with the area of anthropophagy on the Asiatic continent.

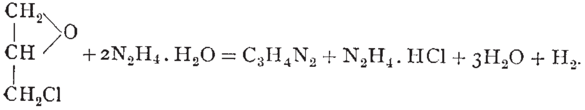
THE Leicester Literary and Philosophical Society has issued the third part of the second volume of its Transactions (new quarterly series). Among the contents are the abstract of an address, by Prof. Flower, on pygmies; a paper on spiders, by the Rev. W. Agar; and a contribution to the pterylography of birds' wings, by W. P. Pycraft.

WE have received Part 20 of Cassell's "New Popular Educator." It is carefully illustrated, and contains maps of Eastern Australia and New Zealand.

MR. JOHN WHELDON has issued a catalogue of zoological works, and papers, transactions, and journals relating chiefly to anatomy and physiology. A catalogue of works on astronomy, magnetism, and meteorology has been issued by Messrs. Dulau and Co.

PYRAZOL, $C_3H_4N_2$, the fundamental base of a rapidly growing series of compounds, has been synthesized by Prof. Balbiano, of Messina, from epichlorhydrin and the recently isolated hydrazine hydrate (*Berichte*, No. 8, p. 1103). Pyrazol is a pentagonal closed chain compound, which may be represented 

The reaction between epichlorhydrin and hydrazine hydrate is a somewhat violent one, a considerable amount of heat being generated. It appears to take place in the manner indicated by the following equation:—



$$\left.\begin{array}{l}CH_2\\ |\\ CH\\ |\\ CH_2Cl\end{array}\right. \!\!>\!O \quad + 2N_2H_4 . H_2O = C_3H_4N_2 + N_2H_4 . HCl + 3H_2O + H_2.$$

Equal weights of epichlorhydrin and hydrazine hydrate, which latter is a liquid boiling at 119° C., are cautiously mixed in a flask, to which is immediately fitted a reflux condenser. The reaction completes itself in 3–4 minutes without any external application of heat. When the reaction is at an end, and the last trace of the epichlorhydrin has disappeared, the flask and contents are heated in a water-bath for 25–30 minutes. After allowing to cool, a quantity of zinc chloride equal to that of either of the reagents is added, in order to facilitate the splitting off of water. The whole is afterwards again heated for an hour over the water-bath. The yellow waxy mass so obtained is then mixed with 300–400 c.c. of water for every 10 grams of either reagent employed, and the mixture distilled in steam. Pyrazol and ammonia distil over in the steam together, and, in order to separate the pyrazol, the distillate is treated with a solution of mercuric chloride, which produces a mixed precipitate of the mercury compound of pyrazol and mercurammonium chloride. The precipitate is suspended in water, decomposed with sulphuric acid, and the solution of pyrazol hydrochloride and salammoniac evaporated to the crystallizing point on the water-bath. The residue is then decomposed by potash, and the pyrazol extracted by ether. Upon evaporation, pyrazol is obtained as a mass of hard colourless needles. The crystals of pyrazol are readily soluble in cold water, with production of a neutral solution. They possess an odour very similar to that of pyridine. They melt to a colourless liquid at 69·5°–70°, and the liquid boils at 186°–188°. The aqueous solution gives a white precipitate with mercuric chloride solution and with an ammoniacal solution of silver nitrate. In all these respects the pyrazol thus prepared from epichlorhydrin and hydrazine hydrate is identical with a substance of the formula $C_3H_4N_2$ prepared some little time ago by Buchner by heatingthe methyl ether of acetyl ene-dicarboxylic-diazoacetic acid. A concentrated hydrochloric acid solution of pyrazol gives, with platinum chloride, a precipitate of lustrous yellowish-red needles of pyrazol-platinate $(C_3H_4N_2 . HCl)_2PtCl_4 . 2H_2O$. When this salt is heated to 205°, the colour changes to straw-yellow, and remains permanent up to 250°. The yellow substance is a definite compound, insoluble in water, and possessing the composition $\left.\begin{matrix}C_3H_3N_2\\C_3H_3N_2\end{matrix}\right>PtCl_2$. It is formed from pyrazol-platinate by loss of two molecules of water and four molecules of hydrochloric acid.

THE additions to the Zoological Society's Gardens during the past week include two Beatrix Antelopes (*Oryx beatrix* ♂ ♀) from Arabia, presented by Colonel Ross; a North African Jackal (*Canis anthus*) from North Africa, presented by Captain Hay; a Common Paradoxure (*Paradoxurus typus*) from India, presented by Mr. C. Armstrong King; a Vociferous Sea Eagle (*Haliaëtus vocifer*), a White-crested Tiger-Bittern (*Tigrisoma leucolophum*) from West Africa, presented by Mr. J. B. Elliot; a Mexican Guan (*Penelope purpurascens*) from Mexico, presented by Mr. J. W. Dawe; two Common Kingfishers (*Alcedo ispida*), British, presented by Mr. T. E. Gunn; a Tawny Owl (*Syrnium aluco*), British, presented by the Hon. C. Parker; two All-green Snakes (*Philodryas viridissimus*), two Natterer's Snakes (*Thamnodynastes nattereri*), two Merrem's Snakes (*Liophis merremi*), a Chequered Elaps (*Elaps lemniscatus*) from South America, presented by Mr. A. C. Derrett; a Barraband's Parrakeet (*Polytelis barrabandi*) from New South Wales, a Brush Turkey (*Talegalla lathami*) from Australia, deposited; an Eland (*Oreas canna* ♂), bred in France, two Diademed Jays (*Cyanocitta diademata*) from Mexico, two Temminck's Tragopans (*Ceriornis temmincki* ♂ ♀) from China, purchased; two Persian Gazelles (*Gazella subgutterosa* ♂ ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on May 29 = 14h. 29m. 9s.

Remarks.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G.C. 3846	—	—	14 14 45	+ 4 26
(2) D.M. + 15° 2758 ...	5	Reddish-yellow.	14 40 45	+15 35
(3) o Boötis	4	Whitish-yellow.	14 40 6	+17 26
(4) ζ Boötis	3	White.	14 35 54	+14 12
(5) χ Cygni	Var.	Very red.	19 46 20	+32 38

(1) There are no very bright nebulæ which come to the meridian near 10 o'clock during this week, but the one given is probably one of the brightest. The General Catalogue description is: "Bright, pretty large; round; pretty suddenly brighter in the middle; barely resolvable (mottled as if with stars); a 12th magnitude star in *nf* quadrant." The spectrum has not been recorded.

(2) According to Vogel and Dunér this star has a magnificent

spectrum of Group II. All the bands 1–9 are plainly visible; they are wide and dark throughout the whole length of the spectrum. The chief observations required of such a star as this are direct comparisons with the bright carbon flutings, as their existence in stars of the 2nd group is still not generally accepted, although Dr. Copeland demonstrated it most conclusively in the so-called "Nova" Orionis. Our ideas of the constitution of this class of stars must turn almost entirely on this point; if the bright flutings exist, the stars, like comets, must consist of discrete masses.

(3) This is a star of the solar type (Vogel). The usual observations are required.

(4) The spectrum of this star is one of Group IV. The usual additional observations are required.

(5) This highly interesting variable will reach a maximum on May 30. The magnitude at maximum varies from 4 to 6·5, whilst that at minimum is below 13. The change of luminosity is therefore enormous, and it is obvious that many of the explanations offered for different kinds of variables, such as variation of spotted area, are quite insufficient for a case like this. The period is about 406 days, but it appears to be shortening. The spectrum is a magnificent one of Group II., and near the maximum last year Mr. Espin noted the presence of bright lines, amongst which the line D_3 was very bright. In future observations, the bright carbon flutings should also be carefully examined, as it seems very probable that, if they exist, they will brighten along with the lines of hydrogen and D_3. If the principal fluting, near *b*, be sufficiently bright, the 2nd maximum of the fluting may be bright enough to be measured. The collision theory of variability seems to explain this class of variable in every detail, even to the lengthening of the period, for the retardation which the secondary swarm would undergo at maximum must inevitably in time lengthen the period.

THE SPECTRUM OF COMET BROOKS (*a* 1890).—On the evenings of May 21, 22, and 23, I made some observations of this comet which may not be without interest. On the 21st the appearance of the comet was not unlike that of the Nebula in Andromeda, except that it was almost circular instead of elliptical in shape. The colour of the comet was whitish, and the nucleus was rather ill-defined. The spectrum was to a large extent continuous, but there were also unmistakable bright flutings. These were brightest in the nucleus, but they also extended faintly throughout the whole mass. Direct comparisons with the blue base of a spirit-lamp flame showed coincidences with all the flutings, except the bright one in the violet which is characteristic of hydrocarbons. The fluting near *b* was by far the brightest, and next in order of intensities came those near λ 474 and 564. The continuous spectrum extended from about D to a little beyond λ 474. On the 22nd the nucleus was much less central than on the previous evening, probably owing to further development of a short bushy tail. The spectrum, however, showed no obvious differences, except that the brightest fluting had slightly increased in intensity. On the 23rd the form and spectrum were practically the same as on the 22nd. The observations were made with a 10-inch refractor, but the comet was easily seen in the 3-inch finder.

The comet had obviously got beyond the earlier temperature stages before I observed it, and it will be highly interesting to notice if the further changes indicated by Prof. Lockyer's discussion of cometary spectra (see p. 20) take place. These will be most obvious in the faintest band (λ 564) owing to the superposition of the bright flutings of manganese and lead. Changes of the form or wave-length of this band should therefore be particularly noted in further observations. It is, of course, desirable that the observations should be made independently by more than one observer. In my observations of May 21 I was very much struck by the resemblance of the comet to the Nebula in Andromeda, both in form and colour, and in spectrum.

On the 27th I again observed the comet, but saw no decided differences, either in its appearance or spectrum.

A. FOWLER.

NEW VARIABLE STAR IN CYGNUS.—Prof. Pickering, of Harvard College, notes in *Astronomische Nachrichten*, No. 2968, that a study of the spectra of the fainter stars is now in progress with the 8-inch Draper telescope. An examination by Mrs. Fleming of photographs taken with small dispersion led to the discovery that the star D.M. + 48°·2940 whose approximate place for 1900 is in R.A. 19h. 40m. 8s., Decl. + 48° 32′ gave a spectrum resembling that of Mira Ceti and other variables of long period. A photographic chart was made, and on comparison with the photographs previously taken of this region proved conclusively that the star is a variable. The photographs compared are of three kinds: (1) trails in which the telescope was at rest and the brighter stars formed lines by their diurnal motion; (2) charts in which the stars formed circular images; (3) spectra formed by placing a prism in front of the object-glass. From the various photographs of the spectrum of this star, it appears that on September 23, 1887, the hydrogen lines *h* and G are shown bright; the star was then estimated as of the 8th magnitude. On June 16, 1888, magnitude being estimated as 9, the spectrum was faintly visible and apparently continuous, but no bright lines were seen. On September 7 of the same year, G was well seen, and *h* was barely visible, the magnitude being again estimated as 8. There is no doubt, therefore, that this is another example of that group of variable stars that exhibit bright hydrogen lines in their spectra when at a maximum.

PARIS OBSERVATORY.—Admiral Mouchez, the Director of this Observatory, has issued his Report for the year 1889. An account of the resolutions adopted last September by the International Committee for the execution of the map of the heavens is given. It is also noted that the building is completed which is to receive in two or three months the *coudé* equatorial, 0·60 metre aperture and 18 metres focus. M. Lœwy has supervised the details of the installation of this instrument, which will replace, with some advantage to Paris Observatory, the instrument 0·74 metre aperture first intended for it. This latter telescope is attached to Meudon Observatory, and will find there atmospheric conditions more favourable for the use of its great optical power than at Paris.

The electric light has been installed for the lighting of the two *coudé* equatorials and the meridian circle.

For some years, almost the whole force of the Observatory has been engaged in re-observing on the meridian the stars in Lalande's catalogue. This work was commenced about twenty-five years ago, and on account of it other branches of astronomy have had to be neglected. It is, however, nearly completed, and Admiral Mouchez proposes to the Council that a regular spectroscopic service should be instituted. Up to now, spectroscopy has only existed nominally at Paris Observatory, and in appealing to the administration for the necessary funds to organize this new department it is very truly observed that no Observatory can well dispense with spectroscopic accessories, since it is the study of this branch of astronomy that enables the physical constitution of the heavenly bodies to be determined. M. Deslandres, already known for his spectroscopic works, will take charge of this new department.

A Commission has been appointed to investigate the inconveniences that would arise from the laying of the proposed railway line at a distance of about 150 metres from the Observatory. The Report of the Commission, when ready, will have some interest at other Observatories that have been similarly threatened.

MM. P. and P. Henry have continued the photographic work: 38 photographs of stars have been obtained, and 5 plates for the determination of the parallax of Victoria. The constant of photographic refraction has been determined, and lunar photographs having a diameter of 40 cm. have been obtained by direct enlargement.

Many observations have been made of comets. M. Bigourdan has made 300 complete measures of nebulæ; the major planets and the asteroids have received as much attention as the continued bad weather permitted; and, leaving out of consideration the absence of spectroscopic work, which another year may see remedied, the Report is altogether a satisfactory one.

ON THE PARALLAX OF DOUBLE STARS.—At the March meeting of the Royal Astronomical Society, Mr. Arthur A. Rambant directed the attention of astronomers to a paper in which he pointed out the relation connecting the parallax and the relative velocity of the components of a double star with the period and angular elements of its orbit, and discussed the possibility of determining the distance by means of spectroscopic observations of this velocity. The photographs of stellar spectra recently obtained by Prof. Pickering in America and Prof. Vogel at Potsdam are in point of accuracy so far in advance of direct eye observations of motion in line of sight that they seem to demonstrate the possibility of applying the method described to the determination of parallax, and the author shows how the parallax (π) of a star can be immediately deduced if its velocity (V) in miles per second in the line of sight has been determined by observation. The advantages to be expected from spectrographic observations of double stars for which πV is greater than 0·1 are shown to be :—

(1) An independent check on the parallax where this has been determined trigonometrically.

(2) A determination of the parallax where, owing to its smallness, the trigonometrical method fails.

(3) A determination of the sign of the inclination which will remove the ambiguity attaching to the situation of the orbit.

It is to be hoped that astronomers who have the requisite instruments for this kind of observation may be induced to take up what appears to be a promising field of work.

TURIN OBSERVATORY.—We have received various publications from the Observatory of the Royal University of Turin. Amongst them we find convenient ephemerides of the sun and moon for 1889 and for 1890 calculated for the horizon of Torino by Señors Porro and Aschieri respectively, and a note by the former observer on the total eclipse of the moon on January 28, 1888. The difference of longitude between the meridian circle at Turin Observatory and Milan Observatory has also been redetermined. The value found in 1823 was 5m. 58·85s., and the value now found is 5m. 58·736 ± 0·006 ; thus the difference between the two observations is only 0·11s., although the former was not made by telegraphy.

A CONTRIBUTION TO THE ETIOLOGY OF DIPHTHERIA.[1]

THE microbe, which was first described by Klebs (at the Wiesbaden Congress in 1883), then isolated and grown in artificial cultures by Löffler (*Mitth. aus dem K. Gesundheitsamte*, vol. ii.) from human diphtheritic membrane, was shown by this observer to act virulently on various animals. The Klebs-Löffler bacillus—by which name the diphtheria microbe is known—is the one with which also Roux and Yersin (*Annales de l'Institut Pasteur*, ii., 1888, No. 12) obtained positive results on guinea-pigs.

In the Reports of the Medical Officer of the Local Government Board for 1888-89 and 1889-90, I have shown that there occur in diphtheritic membranes two species of bacilli, very similar in morphological respects, and also in cultures on serum and on agar, but differing from one another in this, that one species, Klebs-Löffler bacillus No. 1, is not constant in diphtheritic membranes, does not grow on solid gelatine at 19°-20° C., and does not act pathogenically on animals ; the other species, Klebs-Löffler bacillus No. 2, is constant in diphtheritic membranes, in fact is present even in the deeper layers of the membranes in great masses and almost in pure culture, acts very virulently on animals, and grows well on gelatine at 19°-20° C. Löffler, and after him other observers (Flügge, "Die Mikroorganismen," 1886), considered it as a character of the diphtheria bacillus that it does not grow on gelatine below 22° C., but this character, though true of the Klebs-Löffler species No. 1, does not appertain to the diphtheria bacillus species No. 2. In fact, there is no difficulty in obtaining pure cultures of this bacillus on gelatine if a particle of diphtheritic membrane be taken and well shaken in two or three successive lots of sterile salt solution, and from the last lot plate cultivations on gelatine are made. In this way I have obtained the diphtheria bacillus in great numbers of colonies and in pure culture. Zarniko (*Centralbl. f. Bakteriol. u. Parasit.*, vol. vi., 1889, p. 154) and Escherich (*ibid.*, vol. vii., 1890, p. 8) both state that the diphtheria bacillus does grow on gelatine below 20° C.

This bacillus diphtheriæ acts very virulently on guinea-pigs on subcutaneous inoculation ; at the seat of the injection a tumour is produced, which in its pathology and in microscopic sections completely resembles the diphtheritic tissue of the human. In human diphtheria the diphtheria bacillus is present only in the diphtheritic membrane, but neither in the blood nor in the diseased viscera ; the same holds good for the experimental guinea-pigs. In subcutaneous inoculation with artificial culture, though it causes in these animals acute disease and death—the lungs, intestine, and kidney are greatly congested—the diphtheria bacillus remains limited to the seat of inoculation. It was for these reasons that Löffler concluded that in diphtheria the diphtheritic membrane alone is the seat of the multiplication of the diphtheria bacillus, and that here a chemical poison is produced, which absorbed into the system causes the general diseased condition and eventually death. Roux and Yersin have then separated from artificial broth cultures the bacilli and the chemical products, and, by the injection of these latter alone into guinea-pigs, have produced a general effect. I have in this year's Report to the Medical Officer of the Local Government Board (1889-90) shown that in these experiments of injection of cultures into guinea-pigs, an active multiplication of the diphtheria bacilli at the seat of inoculation can be demonstrated by culture experiments ; from the local diphtheritic tumour and the nearest lymph glands the diphtheria bacilli can be obtained in pure culture on gelatine.

On various occasions during the last three years information has reached me by Health Officers (Dr. Downes, Mr. Shirley Murphy, Dr. Thursfield) as to a curious relation existing between a mysterious cat disease and human diphtheria in this manner, that a cat or cats were taken ill with a pulmonary disease, and while ill were nursed by children, and then these latter sickened with well-marked diphtheria. Or children were taken ill with diphtheria, and either at the same time or afterwards the cat or cats sickened. The disease in the cat was described as an acute lung trouble ; the animals were quiet, did not feed, and seemed not to be able to swallow ; in some cases they recovered, in others they became emaciated, while the lung trouble increased, and ultimately they died. In one instance—in the north of London, in the spring, 1889—this cat malady, occurring in a house where diphtheria soon afterwards appeared amongst the children, was of a widespread nature ; a veterinary surgeon—Mr. Daniel—informed me that at that time he had several patients amongst cats affected with the disease, consisting in an acute catarrhal affection, chiefly of the respiratory passages. He furnished me with two such animals : one that after an illness of several weeks had died, another that was sent to me in a highly emaciated state, affected with severe broncho-pneumonia ; this animal was paralyzed on the hind limbs. In both instances the *post-mortem* examination showed severe lung disease, broncho-pneumonia, and large white kidneys due to fatty degeneration of the entire cortex. A similar condition is met with in the human subject in diphtheria. Further, I received from Dr. Thursfield, of Shrewsbury, the body of a cat that had died after a few days' illness from pneumonia in a house in which children were ill with diphtheria ; another cat in the same house that became next ill with the same lung trouble also succumbed. The *post-mortem* examination of the animal that I received showed severe broncho-pneumonia and large white kidneys, the entire cortex being in a state of fatty degeneration.

Subcutaneous inoculations of cats were carried out with particles of fresh human diphtheritic membranes and with cultures of the diphtheria bacillus (Report of the Medical Officer of the Local Government Board, 1889-90) ; hereby a local diphtheritic tumour was produced at the seat of inoculation, and a general visceral disease ; in the cases in which death followed after a few days the lungs were found much congested ; when death followed after one or more weeks, the lungs showed broncho-pneumonia and the kidneys were enlarged and white, the cortex being in a state of fatty degeneration ; if the disease in the animals lasted beyond five to seven days, both kidneys were found uniformly white in the cortex ; if of shorter duration, the fatty degeneration was sometimes only in patches. Although in these experiments the bacillus diphtheriæ was recoverable by cultivation from the diphtheritic tumour at the seat of inoculation, there were no bacilli found in the lungs, heart's blood, or kidney, and the conclusion is justified that, just as in the human diphtheria and in the diphtheria produced by subcutaneous inoculation in the guinea-pig, so also in these experimental cats the visceral disease must be a result of the action of a chemical poison produced by the diphtheria bacillus at the seat of inoculation.

From this it is seen that the similarity between the artificial disease and the natural disease in the cat is very great, and the question that presents itself is, In what manner does the animal receive or give the diphtheritic contagium in the natural disease? The natural disease in the cat is in its symptoms and pathology a lung disease, and it is reasonable to suppose from analogy that the lung is the organ in which the diphtheritic process in the cat has its seat. The microscopic examination of the diseased lung

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[1] Paper read before the Royal Society by Dr. E. Klein, F.R.S., on May 22. This research was undertaken for the Medical Department of the Local Government Board, and was communicated to the Royal Society with the permission of the Medical Officer.